

Under these circumstances, accommodation of a second NGSO MSS system (namely OdysseyTM) in the 29.2-29.250 GHz band provides both a need and a basis for slight revisions to Proposed Sections 25.257 and 21.1002(c).

TRW does not propose any substantive change to Proposed Section 25.257(a)(2) -- a provision that would limit the number of feeder link earth station complexes in the United States (including Alaska and Hawaii) that may be placed into operation to eight. Instead, TRW proposes changes to enable any single NGSO MSS system operator (Motorola, in this instance) to specify locations or location reservations for up to eight feeder link earth station complexes (using the same procedures and geographic breakdowns as stated in Paragraph 62 of the Third NPRM),^{33/} of which that system could place no more than six complexes into operation. A second NGSO MSS system operator (i.e., TRW) could apply for up to two feeder link earth station complexes (again using the same procedures), none of which may be in a top 25 MSA, but both of which could be placed into operation. The number of NGSO MSS systems permitted to operate feeder links in the 29.1-29.250 GHz band would be capped at two.^{34/}

^{33/} See Third NPRM, FCC 95-287, slip op. at ¶ 62. The Commission appears to propose to codify at least some of the regulations governing satellite earth stations in the 29.1-29.25 GHz band in Part 21 of the Commission's rules (see Proposed Rule Section 21.1002(c)). Such a codification would appear, however to exceed the scope of Part 21.

^{34/} The revisions TRW proposes to Proposed Sections 25.257 and 21.1002(c) to implement this approach are included in Attachment 2 hereto. In addition to the substantive changes TRW describes here, it also suggests a number of additional clarifying revisions to Proposed Section 25.257 and Proposed Section
(continued...)

With this approach, the burdens on the LMDS of co-primary sharing with NGSO MSS feeder link networks would be reduced from those contemplated under the proposals advanced in the Third NPRM. First, TRW currently anticipates operating only in 50 MHz of the 150 MHz allocation at its two complexes, leaving the other 100 MHz available at each of those areas for unfettered LMDS operation. Moreover, TRW has no objection to the Commission's suggestion that it may require minimum elevation angles of seven or so degrees for NGSO MSS feeder link earth stations, as its system is much less susceptible to interference from LMDS subscriber transmissions than is Motorola's system (due to the altitude at which the respective systems' space stations operate).^{35/} Finally, TRW requires no modification to the

^{34/}(...continued)

21.1002(c)(2). Specifically, it would correct a cross-reference in Proposed Section 25.257(a)(1); change the term "operated concurrently" in Proposed Section 25.257(a)(2) to "placed into operation," in order to ensure that only eight complexes are built; and would delete subsection (b), as no GSO/FSS systems are proposed for operation at 29.1-29.250 GHz. With respect to Proposed Section 21.1002(c)(2), TRW suggests a slight revision in the timing of the specification of earth station complex locations (the date of auctions is typically announced 45 days in advance, leaving no margin for NGSO MSS feeder link operators). It also seeks to conform the distribution of earth station complexes stated in Paragraph 62 of the Third NPRM with the language of the Proposed Rule. Finally, though it does not do so in Attachment 2, TRW believes that both subsections (c)(2) and (c)(3) of Proposed Section 21.1001 should be moved to Proposed Section 25.257, as they address obligations of NGSO MSS operators. See note 33, supra.

^{35/} Indeed, TRW would have no objection if LMDS systems in the vicinity of either of its feeder link complexes were to locate hub-to-subscriber transmitters using the shared spectrum near those complexes. OdysseyTM spacecraft do not need to be protected from LMDS hub-to-subscriber transmitters operating in accordance with the technical standards proposed by the Commission. Of

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proposed LMDS operating criteria specified in Proposed Sections 21.1018-1022 of the Commission's Rules.

Under these circumstances, TRW believes that there is a way both to enable TRW to use 50 MHz of the co-primary NGSO MSS feeder link/LMDS allocation at 29.1-29.5 GHz in the limited manner it requires for OdysseyTM, and to increase the extent to which sharing can be implemented between the services to a level substantially greater than the Commission envisioned under the single NGSO MSS system-LMDS sharing approach outlined in the Third NPRM.^{36/} It encourages the Commission to make the minor and positive modifications that are proposed here.

^{35/}(...continued)

course, such LMDS transmitters would not be entitled to any protection against interference from OdysseyTM, and such operation would have to be entirely at the risk of the involved LMDS systems. TRW has previously calculated that, assuming no intervening terrain factors, the maximum range of the interference caused by OdysseyTM feeder link earth stations to LMDS systems is on the order of 40 kilometers. See Ex Parte Presentation of TRW Inc. in CC Docket No. 92-297, Letter from Counsel for TRW to Secretary, FCC, at 2 (filed May 18, 1995) ("TRW Band Plan"). Compare Third NPRM, FCC 95-287, slip op. at ¶ 60 (specifying a 75 nautical mile exclusion zone for Motorola feeder link earth stations).

^{36/} See Third NPRM, FCC 95-287, slip op. at ¶ 63 (Commission requests comment on extent to which other sharing methods may be used to permit two-way LMDS operations in the frequency band shared with NGSO MSS feeder links).

B. The Commission Needs To Articulate Principles And Criteria To Govern Co-Frequency Sharing Between NGSO MSS Feeder Links And GSO/FSS Ground Stations At 29.250-29.5 GHz.

One of the areas most substantially affected by the Commission's presumption that TRW no longer seeks to use the 28 GHz band for Odyssey'sTM feeder links is the discussion of the co-primary allocation of the 29.250-29.5 GHz band to NGSO MSS feeder links and GSO/FSS (for Earth-to-space transmissions). The Commission seemed concerned only about the immediate prospect of Motorola's NGSO MSS feeder link system (which would, as proposed in the Third NPRM, have up to eight earth station complexes in the United States that would occupy only 50 MHz of the shared 29.250-29.5 GHz band).^{37/}

As has now been made clear, TRW has a concrete requirement for 300 MHz of feeder link spectrum in the 28 GHz band, and would represent the "potential second MSS system" the Commission mentioned in the Third NPRM. Despite the fact that TRW's requirements were not factored into the Commission's decision to allocate the 29.250-29.5 GHz band on a co-primary basis to NGSO MSS feeder links and the GSO/FSS, TRW now shows that it can satisfy its requirements under the Commission's proposed co-primary allocation, and it identifies here the modest sharing principles and criteria it would like to see in order to ensure that meaningful co-frequency operation of its feeder link complexes and GSO/FSS systems can and

^{37/} See Third NPRM, FCC 95-287, slip op. at ¶ 64.

will occur.^{38/} In this connection, the proposed co-primary allocations mean just that -- each service must expect to bear some burden in sharing the spectrum with the other.

There are two interference cases to address with respect to NGSO MSS feeder link uplinks and GSO/FSS uplinks: (1) interference from NGSO MSS ground stations operating in the 29.200-29.500 GHz band with GSO/FSS satellite receivers; and (2) interference from GSO/FSS ground stations operating in the 29.250-29.500 GHz band with NGSO MSS satellite receivers. TRW offers the following principles to guide co-frequency operation, and proposes that the criteria be codified in the manner proposed in Proposed Section 25.XXX, which is included as Attachment 3 hereto.

1. Principles For Resolving Interference From NGSO MSS Feeder Link Ground Stations Into GSO/FSS Satellite Receivers.

In order to protect GSO/FSS satellite receivers from harmful interference from NGSO MSS feeder link Earth-to-space transmissions at 29.200-29.500 GHz, the

^{38/} TRW notes that the Third NPRM is devoid of any discussion of sharing principles to govern the operation of Motorola's feeder links and GSO/FSS systems in the 50 MHz of spectrum (at 29.250-29.3 GHz) where those services would overlap. This is somewhat surprising, inasmuch as it is TRW's understanding that the service proponents have stated repeatedly (if unofficially) that sharing of any kind between them is not possible. TRW does not try to resolve whatever differences may exist between a Motorola-type feeder link system and a Hughes Communications Galaxy "Spaceway"-type GSO/FSS system. Instead, TRW addresses its demonstration to the issue of the criteria required to enable mutually satisfactory co-frequency operation of an NGSO MSS feeder link system of the OdysseyTM design and a "Spaceway"-type GSO/FSS system.

NGSO MSS satellite system operators and/or the feeder link earth station operator would, as necessary, employ one or more of the following interference mitigation techniques:

- The NGSO MSS satellite system operator will, if practical, phase its orbital constellation, and will coordinate with GSO/FSS operators as to the placement of their spacecraft, to reduce or minimize the likelihood that satellites in the geostationary arc would be illuminated by the NGSO MSS system's earth stations;^{39/}
- The NGSO MSS feeder link earth station operator will site its two feeder link earth station complexes to minimize the number of intersections with GSO/FSS satellites in the 28 GHz frequencies;
- The NGSO MSS feeder link earth station operator will reduce the power levels of its feeder link earth stations so that the signal received at the GSO/FSS satellite is within acceptable levels;^{40/} or
- The NGSO MSS feeder link earth station operator can, if practicable, switch traffic to one or more alternate earth stations whenever a feeder link earth station is in line within $\pm 0.5^\circ$ with a GSO/FSS satellite.^{41/}

^{39/} In the case of OdysseyTM, it is possible to deploy the constellation in such a manner that there would be no instances whereby OdysseyTM satellites would cross the geostationary arc within 0.5° east or west of the orbital location of any of the currently-proposed GSO/FSS systems for the 28 GHz band. See Attachment 4 hereto, at Sections 3.1 and 3.1.1. Attachment 4 contains TRW's demonstration that co-frequency, co-directional sharing between NGSO MSS feeder link and GSO/FSS systems is feasible with certain conditions.

^{40/} See CPM-95 Report to WRC-95 at 42-45; Attachment 4 hereto, at Section 3.1.1.

^{41/} TRW is evaluating whether such a mechanism can be used for OdysseyTM, but early indications are that the cost implications of such a technique -- which would affect satellite design, ground station deployment, and network operation -- would be prohibitive.

These principles would be applied in each instance by the NGSO MSS satellite system and/or feeder link earth station operator, and the operator would have the freedom to determine which, if any one or more, of the mitigation techniques to employ in a particular case. The resolution of this interference case is detailed in Proposed Sections 25.XXX(b) and (c) in Attachment 3 hereto, and places no burden whatsoever on GSO/FSS system operators, although future systems may wish to select orbital locations in the geostationary arc that are separated by 0.5° or more from the intersection point of satellites in the NGSO MSS constellation.

2. Principles For Resolving Interference From GSO/FSS Ground Stations Into NGSO MSS Satellite Receivers.

NGSO MSS satellite receivers such as those on OdysseyTM satellites will require protection against harmful interference from co-polarized GSO/FSS Earth-to-space transmissions at 29.250-29.500 GHz during those times that the GSO/FSS ground stations are in-line within $\pm 1.5^\circ$ of the NGSO MSS satellite. To provide the requisite protection, a GSO/FSS operator must either employ a frequency plan that avoids co-frequency, co-polarization operation in the area of the NGSO MSS feeder link earth station,^{42/} or it must provide a "protection zone" around each NGSO MSS feeder link earth station complex, within which zone GSO/FSS ground stations would be required to limit their transmissions in the 29.250-29.5 GHz band to right-hand circular polarization during in-line interference events.^{43/} The gist of these

^{42/} See Attachment 4 hereto, at Section 4.0.

^{43/} Id. at Section 3.1.2.2.

interference mitigation techniques is described in Proposed Section 25.XXX(a) (which is included in Attachment 3 hereto) and in Attachment 4.

Several aspects of these sharing criteria bear mention, and show that the burden that is placed on GSO/FSS operators is very modest. At no time will GSO/FSS systems have to cease transmissions in the proposed allocations at 28.35-28.6 GHz or in the 29.5-30.0 GHz band, and they will, at all times and at all locations, be able to utilize the channels at 29.250-29.5 GHz that operate with right-hand circular polarization. It is only those few channels on earth stations that operate with left-hand circular polarization in the 29.250-29.5 GHz band that are subject to any transmission limitation, and even then only within the two elliptical protection zones around NGSO MSS feeder link stations during those very brief periods of time when the GSO/FSS earth stations within the protection zone are in-line within $\pm 1.5^\circ$ with an NGSO MSS satellite.^{44/} If the NGSO MSS feeder link earth station complexes were to be located in or near a coastal community, a substantial portion of the protection zone would fall over the ocean, thereby reducing further the already-modest limitation on GSO/FSS use. Even in non-ocean areas, terrain factors such as mountain ranges can reduce the size of the required protection zone.^{45/}

^{44/} As TRW would be the only NGSO MSS feeder link system to operate across the 29.250-29.5 GHz band under the Commission's formulation, as proposed to be modified here, the number of required protection zones that any GSO/FSS system would have to account for in the United States is two.

^{45/} The exact size and shape of the protection zone required for each NGSO MSS feeder link earth station complex will vary with the position of the GSO/FSS system in the geostationary arc.

The burdens of resolving this interference case that must be borne by the GSO/FSS are limited in terms of frequency (one polarization on 25% of the spectrum proposed to be allocated for GSO/FSS use), duration of transmission restriction, and geography (two relatively small areas of the country that may be further reduced by oceans and/or use of larger earth stations). TRW believes that these burdens are both modest (if not de minimis) and reasonable, and it strongly encourages the Commission and the GSO/FSS user community to embrace its approach to meaningful implementation of the co-primary spectrum allocation the Commission has proposed for the 29.250-29.5 GHz band. Adoption and codification of the sharing principles and criteria TRW has identified here will provide necessary guidance for future GSO/FSS systems.

C. The Commission Should Designate The 18.30-18.55 GHz Band As The Paired Band For GSO/FSS Operations At 29.250-29.5 GHz.

In its Third NPRM, the Commission recites that the prospect of NGSO MSS feeder link transmissions in the Earth-to-space direction at 19.4-19.7 GHz -- an element of the U.S. Government's proposals for WRC-95 -- may substantially complicate the sharing scenario between NGSO MSS operations and GSO/FSS space-to-Earth operations in the 19.45-19.7 GHz band (which is the conventional paired downlink band for uplink operations at 29.250-29.5 GHz).^{46/} It asked for comment on whether the downlink band to be paired with GSO/FSS uplinks at 29.250-29.5 GHz should be relocated to the 18.30-18.55 GHz band -- a band segment that is freed

^{46/} See Third NPRM, FCC 95-287, slip op. at ¶ 65.

up by the fact that LMDS system use of what would normally be a satellite uplink band also requires the abandonment of the corresponding downlink band.^{47/}

TRW strongly urges the Commission to proceed with its proposal to specify the 18.30-18.55 GHz band for GSO/FSS downlink operations, regardless of whether the United States' proposal for reverse-band NGSO MSS feeder link operations at 19.4-19.7 GHz is adopted at WRC-95. Clearly, if the reverse-band proposal is adopted, it makes great sense to specify that GSO/FSS systems would use a portion of the downlink band that is left open by virtue of the LMDS use of the uplink band. The constraints that future GSO/FSS systems would have to endure to protect co-primary NGSO MSS feeder link uplinks at 19.4-19.7 GHz would be substantial, and could affect the business case for GSO systems that rely exclusively or heavily on that band for downlink operations. The alternative downlink segment is generally available for GSO/FSS use, and GSO/FSS systems are still at an early-enough phase in their design process to be able readily to accommodate the change in frequency bands.

Even if the WRC-95 does not make the proposed reverse-band allocation for NGSO MSS feeder links at 19.4-19.7 GHz, the Commission should still proceed with its suggested allocation of the 18.30-18.55 GHz band as the paired band for 29.250-29.5 GHz uplinks. Any initiative that the Commission can take to relieve congestion would be welcome.^{48/}

^{47/} Id.

^{48/} TRW does not support the Commission's alternative suggestion that the 29.250-29.5 GHz band GSO/FSS uplinks be paired with downlinks at 19.3-19.425 GHz and 19.575-19.7 GHz. See Third NPRM, FCC 95-287, slip (continued...)

D. Summary

Although TRW does not believe that the Commission's plan represents an ideal solution to the conflicting uses that are proposed for the 28 GHz band, it recognizes the expedience of the segmentation proposal outlined in the Third NPRM, and has striven to demonstrate that it can accept the plan subject to the adoption of modest sharing principles and conditions of use. TRW believes that it has not only been successful in showing that the plan can accommodate OdysseyTM NGSO MSS feeder link uplinks operating on a co-primary basis with the LMDS at 29.1-29.250 GHz and with the GSO/FSS at 29.250-29.5 GHz, but it has also shown that OdysseyTM operations would improve the sharing environment in at least the case of LMDS-NGSO MSS feeder link sharing. It urges the Commission to adopt the suggestions TRW has advanced, and to finalize the NGSO MSS allocations at 29.1-29.5 GHz accordingly.

The public interest is best served by the earliest possible implementation of new communications services that serve the broadest segments of the national and global communities, promote competition among systems, beneficially impact the economy,

^{48/}(...continued)

op. at ¶ 65. This proposal may provide Motorola with 150 MHz of uncongested spectrum, but would do only limited good for TRW's downlinks at 19.4-19.7 GHz (which would still require protection from both GSO/FSS downlink channels). The 18.3-18.55 GHz band is available for use by GSO/FSS downlinks, and should be specified.

and facilitate efficient spectrum usage.^{49/} Ensuring co-frequency sharing among MSS systems in the 28 GHz band would facilitate earlier implementation of MSS and thereby promote these public interest concerns.

III. TRW STRONGLY SUPPORTS THE COMMISSION'S DETERMINATION NOT TO ASSIGN NGSO MSS FEEDER LINK SPECTRUM BY COMPETITIVE BIDDING.

TRW agrees completely with both the Commission's tentative determination not to assign NGSO MSS feeder link spectrum through competitive bidding procedures, and with the underlying rationale articulated in support of that determination.^{50/} The Commission correctly observed that auctioning feeder link spectrum "could significantly delay the development and rapid deployment" of NGSO MSS systems, "could impose significant administrative costs on licensees and the Commission," and does not clearly "promote efficient and intensive use of the spectrum."^{51/} The absence of mutual exclusivity among the two NGSO MSS feeder link users that would be accommodated under the Commission's band segmentation plan (as proposed to be

^{49/} See Second NPRM, 9 FCC Rcd at 1401 (¶ 47(c)) (setting forth the public interest factors for selection of services to operate in the 28 GHz band). Accord Third NPRM, FCC 95-287, slip op. at ¶ 35.

^{50/} See Third NPRM, FCC 95-287, slip op. at ¶¶ 146-147.

^{51/} Id. at ¶ 146.

revised and clarified herein by TRW) also precludes the auctioning of feeder links here.^{52/}

Not only would the auctioning of 28 GHz band NGSO MSS feeder links delay implementation of service to the public, it would create a disparity between the three licensed NGSO MSS systems that would provide one system with an unfair competitive advantage. Only two of the three licensed systems are seeking feeder link spectrum in the 28 GHz band; the third is seeking spectrum in the 5/7 GHz bands. As the lower band is not currently a candidate for competitive bidding procedures, requiring the two systems using 28 GHz band spectrum (even assuming, arguendo, that mutual exclusivity did exist) to pay for access to spectrum would have a disproportionate impact on those systems' up-front costs, and could irrevocably impair what is sure to be a highly competitive marketplace. Furthermore, the Commission has been apprised on repeated occasions of the perils that global satellite systems would face abroad if the Commission were to auction access to spectrum in the United States.^{53/}

The NGSO MSS system licensees and the Commission itself have expended years of work and millions of dollars to establish the "Big LEO" service and verify basic qualifications to construct, launch, and operate state-of-the-art satellite systems.

^{52/} Attachment 1, as noted, contains TRW's demonstration that the feeder links of OdysseyTM and Iridium can share the 29.1-29.5 GHz and 19.3-19.7 GHz bands. Any conflicts concerning the two systems' use of the bands should be fully resolvable through intersystem coordination. See Third NPRM, FCC 95-287, slip op. at ¶ 146.

^{53/} See, e.g., Comments of TRW Inc. in PP Docket No. 93-253 and CC Docket No. 92-166.

Subjecting systems to auctions for feeder links at this late date would be both inequitable and contrary to the public interest. TRW calls upon the Commission to finalize its tentative conclusion that such auctions should not occur.

IV. THE COMMISSION SHOULD NOT TAKE FINAL ACTION IN THIS PROCEEDING UNTIL AFTER THE CONCLUSION OF WRC-95, AS ACTIONS TO BE TAKEN THERE MAY HAVE A PROFOUND IMPACT ON THE VIABILITY OF CERTAIN ASPECTS OF THE BAND SEGMENTATION PLAN.

The Commission recognizes that there is an interrelationship between the band segmentation plan it has proposed in the Third NPRM and the United States Government's proposals for the 28 GHz band at the 1995 World Radiocommunication Conference to be held in Geneva this October and November.^{54/} It asserts that adoption of the U.S. Government's proposals at WRC-95 would facilitate the implementation of the proposed band segmentation plan, while "adoption of different provisions at the WRC-95 could affect the ability to implement the plan."^{55/} The Commission requested comment on the appropriate contingency plans and other relevant developments from the WRC-95 preparatory process.

TRW agrees that the WRC-95, with a number of important and controversial issues pertaining to the 28 GHz band either on the agenda or set to be aired, is pertinent to the outcome of this rulemaking proceeding. In fact, the impact of the allocation and regulatory actions taken at WRC-95 will be felt immediately and

^{54/} See Third NPRM, FCC 95-287, slip op. at ¶ 66.

^{55/} Id.

directly in this proceeding. Given that there are only 30 days or so between the deadline for reply comments in this proceeding and the commencement of WRC-95, it makes little sense for parties to devote substantial energies and efforts to develop contingency segmentation plans. Instead, the Commission should withhold its final decision in this proceeding until after the results of WRC-95 are known, and, if necessary, invite supplemental comments on results that fail to conform with the expectations inherent in the currently-proposed band segmentation plan.

In addition to the question of timing, there is another reason to await the outcome of WRC-95 before taking final action here. Specifically, if the United States Delegation to WRC-95 is able to refer to the Commission's proposal to preclude satellite operations in 850 MHz of spectrum in the 28 GHz band as a mere proposal, it might make the Delegation's task of securing additional and reformed satellite allocations in the same band easier.^{56/} On the other hand, if the Commission has finalized the relinquishment of desirable satellite spectrum to a new terrestrial service that is allegedly incapable of sharing the spectrum with satellite services,^{57/} it will

^{56/} At WRC-95, the United States is seeking allocations for NGSO MSS feeder link systems and NGSO/FSS satellites in the 28 GHz and 19 GHz bands, and is advocating a number of associated regulatory changes.

^{57/} In this respect, TRW disagrees with the Commission's characterization of the results of the Negotiated Rulemaking Committee as determining that sharing between LMDS and NGSO/FSS or GSO/FSS systems is infeasible. See, e.g., Third NPRM, FCC 95-287, slip op. at ¶¶ 15, 43. The Committee did not conclude that sharing was infeasible. It was, in fact, unable to reach a consensus determination on either the feasibility or infeasibility of co-frequency sharing, despite the fact that volumes of data and opinions were submitted on each side of the issue. The absence of a consensus may have been due as much
(continued...)

negatively affect the credibility and likelihood of success of the Delegation's efforts at WRC-95.

Because it may be necessary to revisit the entire band segmentation plan if the outcome of WRC-95 is grossly inconsistent with the U.S. proposals for the conference, TRW finds it necessary to question several intermediate conclusions that were stated in the Third NPRM. Specifically, TRW does not believe that the Commission has provided a rational basis for its tentative conclusion that removing the proposed LMDS to spectrum at 40.5-42.5 GHz -- and thereby restoring the entire 28 GHz band to satellite use -- is not feasible.^{58/} For example, delays of at least 12 to 18 months will occur anyway while auction rules are developed and the licensing process concluded; the European experience and myriad submissions in the record of ET Docket No. 94-124 (which is considering the allocation of 40.5-42.5 GHz for an "LMDS-type" cellular-based service) refute the bald and self-serving assertions of the CellularVision group as to the costs and availability of equipment for LMDS at 40 GHz; and the Commission is capable of making a domestic primary allocation to the

^{57/}(...continued)

to a shortage of time or a clash of obstinate personalities as to an honest belief that co-frequency sharing is not possible. As it may become necessary to revisit the feasibility of spectrum sharing between LMDS and GSO/FSS or NGSO/FSS systems, it would be unfortunate for a Commission mischaracterization of the results of the Committee's efforts to prejudice the analysis of that question.

^{58/} See Third NPRM, FCC 95-287, slip op. at ¶ 36.

fixed service at 40.5-42.5 GHz and precluding domestic Broadcast Satellite Services there.^{59/}

Similarly lacking in a rational basis is the Commission's determination that TRW's May 18, 1995 band segmentation proposal in this proceeding -- whereby TRW proposed, inter alia, to provide 400 MHz of spectrum to NGSO/FSS and 925 MHz of spectrum (all but 200 MHz of which is exclusive primary spectrum) to LMDS -- is not "sufficient to support either the LMDS or NGSO[/FSS] services."^{60/} The only current NGSO/FSS system applicant requested 400 MHz for the type of service link that it represents cannot share with other satellite services^{61/} -- precisely the amount TRW asked the Commission assign for the service.^{62/} Moreover, there is evidence

^{59/} See generally Comments and Reply Comments of TRW Inc. in ET Docket No. 94-124 (filed January 30, 1995 and March 1, 1995, respectively). In this connection, the Commission is correct in concluding that the 40 GHz band is unsuitable for global satellite use due, among other reasons, to the unavailability of international allocations permitting such use. Third NPRM, FCC 95-287, slip op. at ¶¶ 37, 38.

^{60/} See TRW Band Plan, supra at note 35. A copy of the band segmentation proposal from the TRW Band Plan submission is included as Attachment 5 hereto.

^{61/} See Third NPRM, FCC 95-287, slip op. at ¶¶ 23, 56.

^{62/} There is absolutely no basis in the record for the Commission's surprising statement that "designating NGSO/FSS systems to only 400 MHz of primary spectrum, however, could call into question the system's operational ability." See Third NPRM, FCC 95-287, slip op. at ¶ 57. The Commission has the power to order domestic systems to coordinate, without regard to International Radio Regulation 2613. Indeed, the relegation of NGSO/FSS to secondary status in portions of the 28 GHz band outside of 28.6-29.1 GHz is a purely domestic matter. Internationally, the entire 27.5-30.0 GHz is allocated to the
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in the record that indicates that if there is to be only one LMDS system per market, 750 MHz would be a sufficient amount of spectrum for that system.^{63/} The Commission appears not to quarrel with TRW's assertion that 875 MHz of spectrum is sufficient for the GSO/FSS.^{64/}

In short, while the Commission's band segmentation plan is generally a reasonable compromise among the various competing interests for 28 GHz band spectrum, it is dependent to a degree upon the taking of consistent actions at WRC-95. In the event that it becomes impossible to reconcile the results of WRC-95 with the band segmentation plan, the Commission should both call for supplemental comments in December 1995, and revisit the prospects of relocating the proposed LMDS to the 40.5-42.5 GHz band and/or the allocations proposed by TRW in its May 18, 1995 submission.

^{62/}(...continued)

FSS (a designation that includes MSS feeder links) without regard to distinctions for GSO and NGSO systems, and there is an open question as to whether RR 2613 can be applied as between administrations without a prior coordination agreement between the operators of the GSO and NGSO systems having been reached. See Big LEO NPRM, 9 FCC Rcd at 1129-1130 (¶ 73).

^{63/} See Ex Parte Comments of Gigahertz Equipment Company, CC Docket No. 92-297 (filed June 6, 1995). Although the Commission references this filing in another context, it does so in a way that never reveals the fact that Gigahertz Equipment indicated not only that 750 MHz is sufficient for a single LMDS system, but that in the event insufficient spectrum is available for LMDS at 28 GHz, the Commission should allocate spectrum for the service at 40.5-42.5 GHz. See Third NPRM, FCC 95-287, slip op. at ¶ 76 (citing Gigahertz Equipment Company submission).

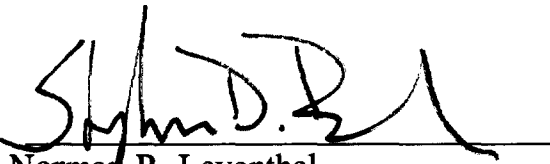
^{64/} See id. at ¶ 46.

CONCLUSION

On the basis of the foregoing discussion, TRW respectfully urges the Commission to fine tune its proposed segmentation plan by adopting the minor clarifications and sharing principles proposed herein to facilitate co-frequency sharing between NGSO MSS feeder links and LMDS and GSO/FSS. These modest adjustments will ensure that all applicants in each service category are treated even-handedly and provided with an opportunity to satisfy its spectrum requirements, that the 28 GHz band is used efficiently, and that competition among NGSO MSS systems can occur without the unnecessary cost and delay that otherwise would result.

Respectfully submitted,

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September 7, 1995

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ATTACHMENT 1

Co-Directional Frequency Sharing Between Two NGSO MSS Feederlink Systems in The 28/19 GHz Band

1.0 Introduction

This paper presents analysis and simulation results related to the feasibility of co-directional frequency sharing between two NGSO MSS feederlinks system in the 28/19 GHz band. The Odyssey system and the Iridium system are used as an example of two NGSO MSS systems with the feederlinks operating in 28/19 GHz band. The analysis and simulation of these systems and their "in-line" interference events provides valuable information to determine the possibility of co-directional frequency sharing between these types of systems at 28/19 GHz band.

2.0 Technical Characteristics of Satellite Systems

The Odyssey system constellation comprises twelve satellites in three orbital planes at an inclination of 50 degrees to the equatorial plane. Each satellite is placed in circular orbit at an altitude of 10355 Km. The Odyssey system uses the L-band 1610 to 1626.5 MHz for the mobile return link from the user to the satellite. The mobile forward link from the satellite to user uses the S-band 2483.5 to 2500.0 MHz.

In November 1994, TRW requested the 19.8 to 20.1 GHz and 29.7 to 30.0 GHz bands for the feeder return link from the satellite to the earth station and the feeder forward link from the earth station to satellite, respectively. These frequency bands are currently allocated for FSS. However, because the United States proposals for WRC-95 do not contemplate NGSO MSS feeder link operations in the bands selected by TRW, TRW expects to shortly modify its authorization to specify the 19.4 to 19.7 GHz and 29.2 to 29.5 GHz bands for the feeder return link and feeder forward link, respectively.

The Odyssey satellite payload functions as a simple bent pipe, frequency translating transponder. For the mobile link, each satellite has the multi beam antenna with 40° field-of-coverage. In the feeder link, each satellite has three independent steerable antennas with spot beams for both transmitting and receiving signals to/from multiple gateway. The 3 dB beamwidth of the transmit and receive antennas are 3° and 2.2°, respectively.

The Iridium system constellation comprises 66 satellites in six near-polar orbits with an inclination angle 86.4° at approximately: 787 Km above the Earth. The Iridium system uses part of the L-band 1610 to 1626.5 MHz for the mobile return user to satellite link and mobile forward satellite to user link. The Iridium system would use the 19.4 to 19.6 GHz and 29.1 to 29.3 GHz

bands for the feeder return satellite to earth station link and feeder forward earth station to satellite link, respectively. For the mobile link, each satellite has a 48 beam antenna with 126° field-of-coverage.

The orbital characteristics of the Odyssey system and the Iridium system are given in Table 2.1.

Table 2.2 shows the satellite communication system parameters.

Table 2.3 shows the earth station communication system parameters.

Table 2.1: Orbital Parameters

Parameters	Odyssey (NGSO MSS)	Iridium (NGSO MSS)
Number of satellites	12	66
Number of orbital planes	3	6
Number of satellite/plane	4	11
Altitude	10355 Km	787 Km
Inclination angle	50°	86.4°
Period of orbit	5.98 hours	1 hour and 40 minutes

Table 2.2: Satellite Communication System Parameters (Feederlinks)

Satellite Parameters	Odyssey (NGSO MSS) (Feederlinks)	Iridium (NGSO MSS) (Feederlinks)
Receive frequency range	29.2 to 29.5 GHz	29.1 to 29.3 GHz
Receive bandwidth	300.0 MHz	200.0 MHz
Receive Polarization	LHCP	RHCP
Receive antenna gain (Peak)	38.5 dBi	30.1 dBi
3 dB beamwidth	2.2°	5.7°
Receive total system noise Temperature	780° K or 28.9 dB-K	1295.5° K or 31.1 dB-K
Transmit frequency range	19.4 to 19.7 GHz	19.4 to 19.6 GHz
Transmit bandwidth	300.0 MHz	200.0 MHz
Transmit Polarization	RHCP	LHCP
Transmit AEIRP (Peak)	46.4 dBW	13.5 to 23.2 dBW/ per
Transmit Signal AEIRP	~37.0 dBW	channel
Transmit antenna gain	35.7 dBi	26.9 dBi
3 dB beamwidth	3.0°	8.27°
Transmit power density into antenna	-65 dBW/Hz (peak)	-77.8 to -67.9 dBW/Hz

Table 2.3: Earth Station/User Communication System Parameters (Feederlinks)

Earth Station/ User Parameters	Odyssey (NGSO MSS) (Feederlinks)	Iridium (NGSO MSS) (Feederlinks)
Transmit frequency range	29.2 to 29.5 GHz	29.1 to 29.3 GHz
Transmit bandwidth	300.0 MHz	200.0 MHz
Transmit Polarization	LHCP	RHCP
Transmit EIRP	85.9 dBW (peak)	68 dBW (peak)
Transmit antenna gain	64.8 dBi	56.3 dBi
3 dB Beamwidth	0.11°	0.28°
Transmit power density into antenna	-55.49 dBW/Hz (peak)	-52.9 dBW/Hz (peak)
Receive frequency range	19.4 to 19.7 GHz	19.4 to 19.6 GHz
Receive bandwidth	300.0 MHz	200.0 MHz
Receive Polarization	RHCP	LHCP
Receive antenna gain	60.8 dBi	53.2 dBi
3 dB Beamwidth	0.17°	0.40°
Receive antenna noise temperature	666.5 ° K or 28.2 dB-K	731.4° K

2.1 The Odyssey and the Iridium Antenna Patterns

2.1.1 Earth Station Antenna Patterns

The Odyssey earth station transmit and receive antenna patterns are shown in Figures 2-1 & 2-2, respectively.

The Iridium earth station transmit and receive antenna patterns are shown in Figures 2-3 & 2-4, respectively.

2.1.2 Satellite Antenna Patterns

Figures 2-5 and 2-6 show the Odyssey and the Iridium satellite antenna patterns, respectively

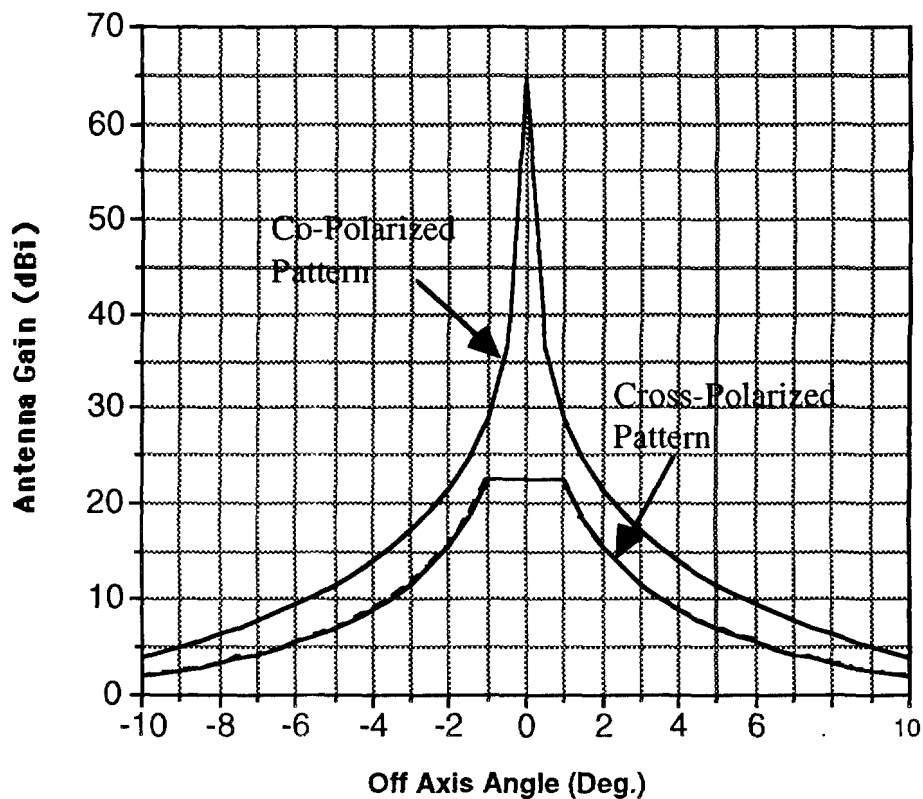


Figure 2-1: The Odyssey E/S Transmit Co & Cross-Polarized Antenna Patterns
(Based on CCIR Rec. No. 580 & 731)

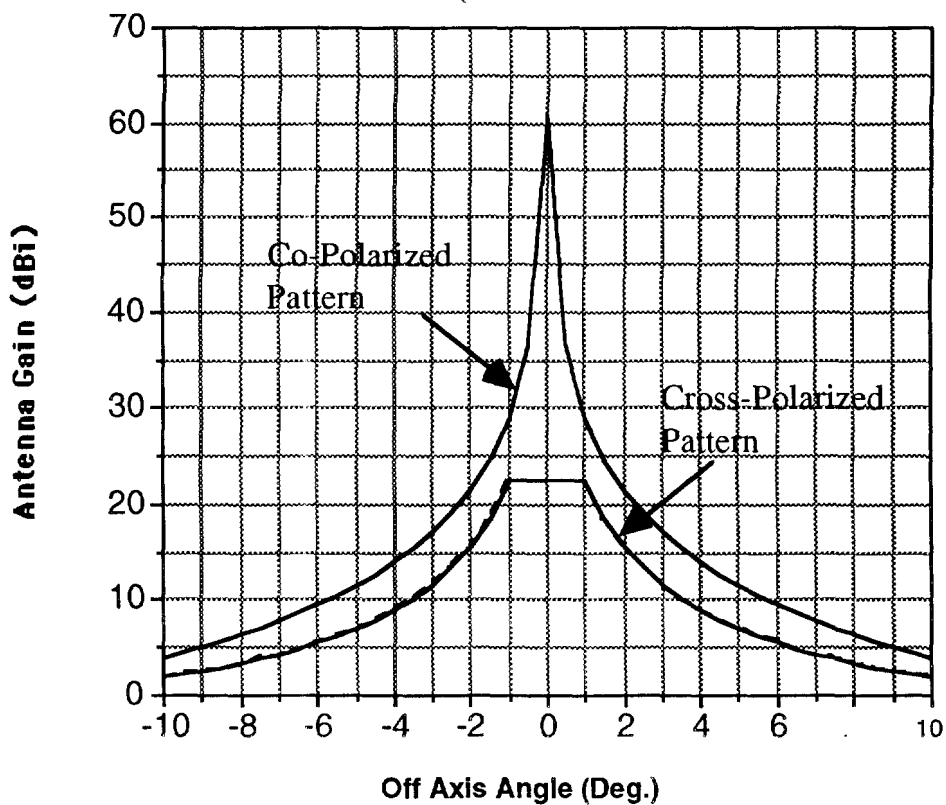


Figure 2-2: The Odyssey E/S Receive Co & Cross-Polarized Antenna Patterns
(Based on CCIR Rec. No. 580 & 731)